NOTES ON AUSTRALIAN AND EXOTIC SARCOPHAGID FLIES.

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(Eleven Text-figures.)

[Read 26th October, 1927.]

Taxonomic studies of Sarcophagidae, undertaken since the publication in 1923 of "A Revision of the Australian Diptera belonging to the genus *Sarcophaga*", by Professor T. Harvey Johnston and myself, were pursued with the view of ascertaining the relationship between Australian species and those examined or that had been described from other parts of the world. The accumulation of odd notes so far compiled will prove, I believe, of considerable interest and perhaps help towards establishing a satisfactory method of arranging the unwieldly genus *Sarcophaga* into groups of naturally allied species.

The idea of grouping Sarcophagids on the genital characters of the male, which has been initiated by various authors, is extended and developed in the present paper. Already types like *S. tuberosa* have had placed around them names ranking as varieties or species according to the interpretations given by the authors concerned, but unfortunately drawings of the gross appearance of the male genitalia are usually relied upon in order to show the alliances whilst no attempt has been made to define the associations. The genital complex of the male is a structure worthy of detailed study and until it has been given adequate treatment relationships between species must remain obscure.

Although highly specialized structures such as the bifid anterior clasper of the *antilope*-group and the spiny anterior appendage of the *peregrina*-group would be enough to suggest the alliance, reliance is not placed on such characters alone, additional characters are taken into consideration and it is upon such combinations that relationships are best assessed. The counterpart of any one character may readily be found in the composition of the genitalia of species belonging to quite different groups as instanced by the *misera*-group, that has one or more of its characters found in *S. securifer*, *aurifrons* and *omega*. Owing to necessity for caution in these matters only three groups are dealt with in full. Biological data are given for one species.

For material supplied and used for the purpose of this paper, I am indebted to Dr. H. H. Karny for two species bred by him in Java, the types of which by request, are returned for preservation in the Museum there; also to Dr. R. J. Tillyard for three specimens of the only *Sarcophaga* described from New Zealand, one of which was returned to him for preservation in the Cawthron Institute; to Mr. R. R. Parker for a collection of Sarcophagids, mostly American but including some Indo-Australian forms; and to Mr. R. Senior-White for Oriental material in which I was specially interested.

Method of preparing and mounting genitalia.—The published methods, whereby the genitalia are prepared for examination (given by Parker, Senior-White, and Johnston and Hardy), differ fundamentally and for the purpose of detecting finer

points in the structure of genitalia in the first two cases mentioned, I find that given by Parker is superior to that given by Senior-White. For examination of genitalia *in situ*, I use a system of reflecting sunlight on the parts examined and any distortion or contortion is thus detected under the Greenough stereoscopic binocular microscope, moreover the finer structural details, so often overlooked, become clearly defined under this method. The genitalia may be removed and mounted without distortion, rendering all external details clear on a slide; after removal, passing through absolute alcohol, clearing in xylol or clove oil (boiling in potash is not permissible in this case), the genitalia can be mounted whole or in sections in Canada balsam in such a manner as not to flatten out the parts. The parts of the penis are then easily viewed through transmitted as well as reflected light in the position they would occupy relative to each other just as if left set in the normal way. This method of mounting has the advantage that higher powers of the microscope can be brought to bear upon details too small to be seen plainly under the binoculars, if left *in situ*; the densely spined nature of the anterior appendage of *S. peregrina* being a case in point.

S. antilope group.

The six species, referred to this group, agree in having the anterior clasper bifid and with a small knob placed anteriorly to it. The forceps are long, strong and angulated. The second segment of the penis lacks the lateral process, but the shape differs in other respects. Those species that have the anterior clasper bifid for only half the length, have also the apical process tridentate, whilst the two species that have this clasper short and bifid to the base do not have the tridentate character of the penis. As far as yet known the group consists of:

antilope Bottcher, 1913, Formosa.
**alpha* Johnston and Tiegs, 1921, Australia.
**beta* Johnston and Tiegs, 1921, Australia.
**zeta* Johnston and Tiegs, 1921, Australia.
**howensis* Johnston and Hardy, 1923, Lord Howe Island.
**antilopoides*, n. sp., Java.
The asterisk refers to species examined.

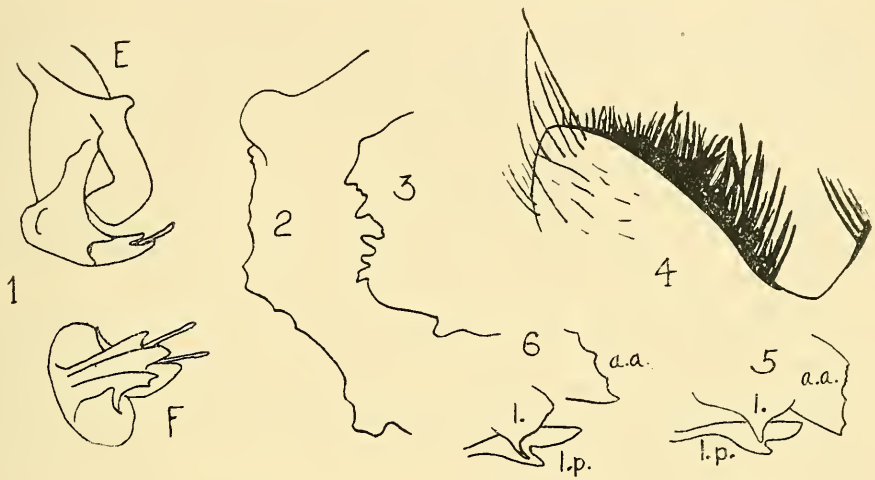
Sarcophaga antilopoides, n. sp. (Text-fig. 1.)

Status.—There are eleven names previously attributed to Sarcophagids recorded from Java, and Dr. H. H. Karny has succeeded in breeding only two species. As pointed out below, *S. fuscicauda* has been misidentified and is described here under the name *S. karnyi*. *S. taenionata*, according to Senior-White, may possibly be *S. flavipalpis*, one of the *misera*-group. From the same source it is suggested that *S. javana* may be *S. aurifrons* Doleschall (*i.e. doleschali* J. and T.). Other names are *lineatocollis* Macquart, *flavinervis* Senior-White, *knabi* Parker, *albiceps* Macquart, *orientalis* Parker and *dux* Thomson. I can see no evidence to suppose that *antilopoides* has been referred to under any of these names, and all of them, with the exception, perhaps, of the unknown *lineatocollis* may be excluded from this consideration.

When this species was first received I considered it to be *S. antilope* Bottcher, originally described from Formosa, but later, when comparing the genitalia with the drawing of *S. antilope* from India by Senior-White, I became doubtful about the determination. Under the circumstances it seems advisable to give a new name to the species here described which cannot be considered identical to the Indian species and there is sufficient published evidence to conclude that the

Formosan species is also not the same. According to Senior-White's drawing there is an elongate lobe, hooklike in shape, and this appears to be indicated in the drawing by Bottcher, but hidden between the anterior process and the sheath of the penis. This shape is in no way indicated on any of the other forms. There can be no doubt that the Indian and Formosan forms belong to this group but their specific identity requires further consideration.

Description.—Male: Head, outer vertical bristles much smaller than the postoculars; thirteen frontals, two rows of eight facials; about nine orals; one



Text-fig. 1. Male genitalia of *Sarcophaga antilopoides*, n. sp.—second segment of the penis only. *E*, lateral view; *F*, ventral view.

Text-fig. 2. Outline at the apex of the puparium of *S. misera*, seen laterally.

Text-fig. 3. The same of *S. kohla*.

Text-fig. 4. The last abdominal sternite on *S. misera*—half of the apex only.

Text-fig. 5. Apex of the lateral process, *l.p.*, the lobe, *l*, and the anterior appendage, *a.a.*, of *S. misera*, seen laterally.

Text-fig. 6. The same of *S. ceylonensis*.

row of postoculars. Thorax, two intra-alars, the presutural and scutellar bristles well developed. Abdomen, on the first segment one row of only a few discal lateral bristles and one, sometimes two, submarginals, and on the third one median pair and two or three lateral submarginals; on the fourth segment five or six submarginals alternating with well developed marginals.

Genitalia: Similar to that of *S. beta*, but reddish, the forceps and claspers being identical. The anterior appendage is simple but there are three minute spine-like processes along the upper anterior edge of each half; the apical process is rather slender towards the apex which is tridentate and has a pair of lateral projections that are similar in position, but not shape, to those on *S. howensis*; the filaments protrude.

Legs: The chaetotaxy conforms to the general type except in the two ventral rows on the posterior femora which are very much reduced; long hairs occur on all femora and on posterior tibiae.

Female: The frontal bristles may be as few as eight or nine and the first abdominal segment usually has two rows of discal lateral bristles and the ventral bristles on the posterior femora are well developed. In other respects the characters conform to those of the male, excluding the sexual characters.

Habitat.—Java: Buitenzorg, October, 1923, 26 males, 24 females (H. H. Karny), all bred.

Sarcophaga tryoni Johnston and Tiegs.

Amendment.—Subsequent to the publication of the figure of the genitalia of this species, a number of dissections was made for the purpose of studying the complex structure of the second segment of the penis and in so doing the filaments previously stated as absent were found to be present. When drawing Text-fig. 9 (Johnston and Hardy, 1923), they were mistaken for projections of the lobe and in consequence the lobe illustrated in Text-fig. 9, *E*, if corrected, should be rounded and the filaments made to coincide with what is there shown to be the projection of the lobe. The presence of this filament should also be corrected in the key and in the description. It is possible that the filaments will also be found (perhaps in a vestigial or rudimentary state) in other species, so for the character given in the key "filaments absent" should read "filaments apparently absent".

Biology.—The seasonal preponderance of certain Sarcophagas in Brisbane is a well recognized phenomenon. A few species are readily bred in carrion, the most persistent of which is *S. tryoni*. It was noticed, however, that for three months of the year, although adults were captured, they failed to appear in the carrion. The reason for this non-appearance amongst bred blowflies during June to August was discovered during experiments upon the pupal period conducted under uniform temperature control.

Of all the blowflies tested, and at every temperature experimented with, it was found that the pupal period was consistent in its duration; a formula was worked out from a chart, and the maximum temperature at which the flies would hibernate was calculated, the result being contrasted with the winter behaviour of the flies bred under more natural conditions.

Under normal conditions maggots of *S. tryoni* deposited on the 9th May, required 31 to 149 (average normal 133) days to complete their metamorphosis, or roughly from one to five months. Of this period seven days were spent in the carrion, five to eight subsequent days were passed before pupation took place, and from 19 to 136 (normal average 120) days were spent in the puparium. The number of adults reared in this experiment was 26. The normal average was based on figures that excluded a small percentage of abnormally quick developments.

A still more striking effect was produced by maggots deposited a month earlier, on the 7th April, when again seven days were spent in the carrion, 6 to 24 days elapsing before pupation took place and 17 to 163 subsequent days (well over five months) passed before the adult emerged, thus taking from 31 to 177 (normal average 165) days to complete metamorphosis, or roughly one month and nearly six months. The total number of adults bred in this batch was 111.

Further observations elicited the fact that the adults did not survive a cold night, but succumbed at a temperature of about 55° F., or perhaps higher.

When incubation tests were charted for the various species of *Sarcophaga* experimented with, it was found that the probable maximum hibernation

temperature varied with the species, that of *S. tryoni* being the highest, reaching 60° F. During much of the Brisbane winter the day temperatures scarcely rise above this, except in the sun, and even in the case where a puparium may be subjected to 65° F. continuously, 22 days must elapse before the adult emerges. A few hours daily at such a temperature would cause the pupa to develop exceedingly slowly, extending the three weeks to as many months. On the same formula at 70° F the puparium would be found to take 16 days to complete development, but above that the increase in temperature causes a much more rapid development, until at 95° only about 11½ days elapse.

There is a record during January of a nine-day pupal period, this being the minimum recorded, but 11 days seems to be the normal minimum whilst the absolute minimum according to formula is 10 days. The record of a nine-day period is possibly an error that should be applied to *S. froggatti* which was frequently bred with the present species.

Sarcophaga misera and *S. peregrina* are the two dominant winter species in Brisbane, and are readily bred during that season. Not only have they a hibernating temperature lower than that of *S. tryoni*, but also the ultimate minimum development period is about six and seven days, nor are the adults so liable to succumb during cold nights.

For *S. tryoni*, the formula is: $(x - 10)\ (y - 60) = 60$. In this x represents the period in days and y the temperature (Fahrenheit). It will be found approximately correct for all temperatures from 65° to 88° F., which is the range over which the temperature experiments were conducted.

The table given covered four years' research, but irrespective of the years, the months are given in sequence, and the flies were bred under more or less natural conditions. This is the only species of the genus with which the year's cycle was practically completed. Even in this case one month was missed, namely October, but an additional and early deposition in November has rectified the omission to some extent. From this table it will readily be recognized that on the average some eight or nine generations of *S. tryoni* occur during a year; the maximum could scarcely exceed ten and the minimum is seven.

LIFE CYCLE OF SARCOPHAGA TRYONI.

Date of Deposition.	Jan. 18	Feb. 5	March 6	April 7	May 5	Sept. 10	Nov. 2	Nov. 15	Dec. 18
Time spent in carrion ..	6	6	6	7	7	7	6	6	5
Time occupied before forming puparium after leaving carrion	1-11	1-6	6-9	6-24	5-8	5-7	2-10	3-6	3-7
Time spent in puparium	9-14	11-15	13-16	17-163	19-136	16-18	12-14	13	11-12
Maximum and Minimum number of days occupied in completing metamorphosis	17-28	20-26	28-29	31-177	31-149	29-32	20-29	20-29	20-24
Normal average number of days occupied in completing metamorphosis	21	23	28	165	133	30	25	25	22
Number of specimens bred	53	85	12	111	26	25	60	7	11

S. misera-group.

Synonymy, *tuberosa*-group, *dux*-group.

The seventeen forms referred to here, agree very consistently in the shape of the second segment of the penis. The lobe is well indicated with regard to its position and may even contain a projection of considerable magnitude, whilst the lateral process is long, usually rigid and pointing more or less horizontally in direction. The apical process is almost invariably restricted to a minute point and the filaments project to at least just beyond the apex of the segment, always being conspicuous.

S. eta conforms to the above characters and therefore is placed here. The appendages, lobes and filaments are all exceptionally long but in other respects the species conforms to the *misera*-group. Bottcher gave the name *tuberosa*-group to this conception without defining it and the name was changed later by Parker to the *dux*-group but as *misera* was the first name published of those species considered here, the name apparently being correctly applied by Johnston and Tiegs, it became necessary to change the group name once more.

Senior-White sinks *S. luzonensis* and *S. ceylonensis* as variations of *S. dux*, but I think this conception is erroneous. Senior-White and Parker differ in their methods of examining genitalia and would naturally reach different conclusions. The following list of names are applicable to species of this group:

**misera* Walker, 1849. Australia.
aurifrons Doleschall, 1858; preoccupied by Macquart, 1846. See *doleschali* Johnston and Tiegs.
**dux* Thomson, 1868, Pacific Islands.
tuberosa Pandel, 1897, Europe, Asia.
harpax Pandel, 1897, North America, Europe, Asia, India, Philippine and Pacific Islands.
exuberans Pandel, 1897, Europe, ? Africa and North America.
sarracenoides Aldrich, 1916, N. America.
knabi Parker, 1917, Philippine Islands.
luzonensis Parker, 1919, Philippine Islands.
**eta* Johnston and Tiegs, 1921, Australia.
doleschali Johnston and Tiegs, 1921 (new name for *aurifrons* Doleschall, *nec.* Macquart).
**shermani* Parker, 1923, Canada.
**ceylonensis* Parker, 1923, India, Ceylon and Malay Peninsula.
craggi Parker, 1923, India, Africa.
marshalli Parker, 1923, Europe.
**kohla* Johnston and Hardy, 1923, Australia.
flavipalpis Senior-White, 1924. India.
scopariiformis Senior-White, 1927, Ceylon.

SARCOPHAGA MISERA Walker. (Text-figures 2, 4 and 5.)

Sarcophaga misera, Johnston and Hardy, PROC. LINN. SOC. N.S.W., 1923, p. 113, fig. 14.—*S. knabi*. Senior-White, *Rec. Ind. Mus.*, 1924, xxvi, p. 234 (N. S. Wales specimens only).

Synonymy.—Senior White refers to some New South Wales specimens sent to Patton by Froggatt under the name *aurifrons*. Froggatt used that name covering at least five species of which *S. misera* is one and moreover *S. knabi* to which Senior-White referred the specimens has not been found in Australia. It is very evident that the present case is one of misidentification, the identity of two species being confused owing to the general similarity of the male genitalia.

Structure.—Various drawings illustrate the apex of the last ventral segment of the male abdomen, showing conspicuously differences in the various species of

the *misera*-group. The drawing of the same part of the typical form is given here (Text-fig. 4, representing half only), and it will be noted that this does not agree with that of any other species of the same group published by various authors.

SARCOPHAGA CEYLONENSIS Parker (Text-fig. 6.)

A paratype specimen of this species, compared with *S. misera* shows a marked difference in the dentations along the anterior edge of the anterior appendage (compare Text-figs. 5 and 6). Unfortunately my male specimen of *S. dux* from Hawaii has the penis missing, but judging from the results of comparing the other parts and characters with those of *S. misera*, it also should differ in detail from *S. ceylonensis*. The dentations referred to on *S. misera* are consistent for several hundred specimens examined, not one being found to vary to the extent of missing one of the dentations. Senior-White in discussing the synonymy leaves no doubt that he suggested *ceylonensis* was a synonym of *S. dux* without having made an attempt to separate the forms on differences in the genitalia, so it would seem this matter requires further consideration.

SARCOPHAGA KOHLA Johnston and Hardy. (Text-fig. 3.)

Johnston and Hardy, PROC. LINN. SOC. N.S.W., 1923, p. 113, Text-fig. 14.—*S. luzonensis* Parker, *Bull. Brooklyn Entom. Soc.*, 1919, xiv, p. 43. (Specimens from Queensland only).

In referring to a specimen from Townsville (Q.), Parker drew attention to the fact that it did not agree with specimens from the Philippine Islands so he placed it with his *S. luzonensis* as an atypical specimen. Probably the specimen conforms to the one described later as *S. kohla*.

The male has long been known, but only a few specimens were to be found in the various collections. More recently the species was bred by me from the contents of decayed shells at Great Palm Island, near Townsville, and both sexes secured in this manner. Females were also captured on the wing and at the same time *S. beta, tryoni, aurifrons, omega, gamma* and *misera* were captured but none of these was bred.

Description.—Female: The chaetotaxy is similar to that of the holotype male except the outer verticals are strongly developed, the frontals have eight bristles on one side, nine on the other, there are three rows of postoculars. Only two intra-alar bristles are present and the discal laterals on the first abdominal segment are reduced so that the second row is represented by one bristle. The legs are free of long hairs.

The puparium differs from that of *S. misera* by having protuberances (Text-fig. 3) around the apical cavity wherein the larval spiracles were situated; seen laterally this orifice is thus shown to be surrounded by conical projections whereas on *S. misera* (Text-fig. 2), the corresponding line is practically straight. This character is enough to confirm the specific status of *S. kohla* indicating that it cannot be a variation of *S. misera* as has been expressed in correspondence that I have received.

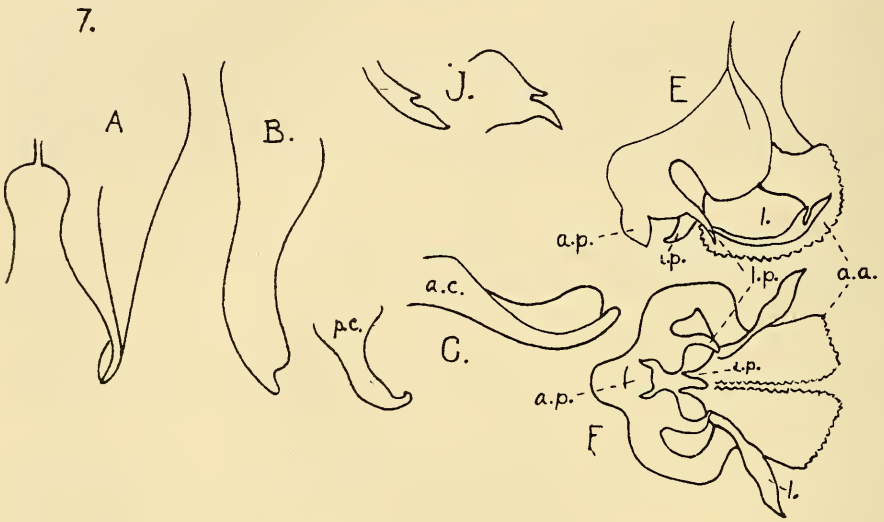
Habitat.—Queensland: Great Palm Island, May, 1925. Female allotype and a male bred from decayed Molluscs, and three paratype females captured on the wing. Other puparia were secured, but failed to develop.

S. peregrina-group.

The three forms referred to here, agree in the structure of the second segment of the penis. A most suggestive point with regard to the relationship is to be found

in the nature of the anterior appendage, a large surface of which is formed into a mass of minute spines. The widely expanding bifid lobe, the shape of the complex lateral process and the small apical processes are similar in each case, showing a very close affinity between the species. There are four names standing under this group:

**peregrina* Robineau Desvoidy, 1830. Australia.
**fuscicauda* Bottcher, 1912, Formosa.
**hudsoni* Parker, 1923, Ceylon; placed as a synonym of *fuscicauda* by Senior-White.
**karnyi*, n. sp. Java.



Text-fig. 7. Male genitalia of *Sarcophaga karnyi* n. sp. The lettering conforms to that given by Johnston and Hardy, 1923, namely: *A.*, forceps or apical part of them seen posteriorly; *B.*, the same lateral view; *C.*, claspers; *D.*, another aspect of one or both claspers; *E.*, second segment of penis seen laterally; *F.*, the same ventral view; *G.*, the same or its apex seen posteriorly; *H.*, the same, seen anteriorly; *J.*, apex of the lobes seen from other aspects. *a.a.*, anterior appendage; *a.c.*, anterior clasper; *a.p.*, apical process; *fil.*, filaments; *i.p.*, interior process; *k.*, knob; *l.*, lobe; *l.p.*, lateral process; *p.c.*, posterior clasper.

SARCOPHAGA KARNYI, n. sp. (Text-figure 7.)

Specific identity.—Although I unhesitatingly placed this species as a new form when first received, I now have reason to believe it may have been confused with *S. fuscicauda* Bottcher, originally described from Formosa and recorded from Java and subsequently other places. Mr. Senior-White has supplied *S. fuscicauda* from India and this has a very distinctive character differing from that of the Javanese form. The main sheath of the second segment of the penis is plain on the rear in *S. peregrina* and in the present species, whilst that of the Indian form is provided with a hood projecting rearwards, a character and position for an appendage that I have not seen equalled in any other Sarcophagid. As it seems advisable to record these differences under specific names, the Javanese species is given a new name and it is taken for granted that the Indian form is identical with that from Formosa, which I have not seen. *S. hudsoni* Parker is the same as the Indian *fuscicauda* as Senior-White pointed out.

Description.—Male: Head with the outer vertical bristles as short as the postoculars; ten to fourteen frontals; about six facials; about eleven orals; and two

rows of postocular bristles. On the thorax two or three intra-alars, the presutural and prescutellar bristles are present. The abdomen has on the first segment one row of three discal-laterals and two submarginal bristles; on the second two lateral submarginals and on the third one median pair and three lateral submarginal bristles.

The genitalia are remarkably like those of *S. peregrina*, the forceps being similar in outline as well as the penis. The anterior claspers are much longer than the posterior ones and provided with a broad flange on the inner side at the apex and on the outer side at the base. Anterior appendage with a minutely spined area that is represented in the figure by a serrated edge; lobe large and broad with two conspicuous projections; lateral process broad at the base and produced into a slender projection continuing from its lower edge; apical process unpaired and short; between the lobes there is a process that evidently represents the interior process found on *S. peregrina*, but where it arises from has not been determined; not only does this process appear to arise from a different position, but also it differs in shape.

The chaetotaxy of the legs conforms to the general type; scanty long hairs occur on the posterior femora only.

The female differs from the male in having the second postocular row of bristles weak or absent; the discal lateral bristles of the first abdominal segment are more numerous and are arranged in two rows.

Habitat.—Java: Buitenzorg; holotype, allotype and a female paratype were bred from a beetle (*Xylotrupes*) in June, 1924, whilst the paratypes male (16.5.1923) and female (11.5.1923) and another female undated were bred from *Gryllotalpa*. All these were received from Dr. H. H. Karny after whom the species is named.

Other Groups.

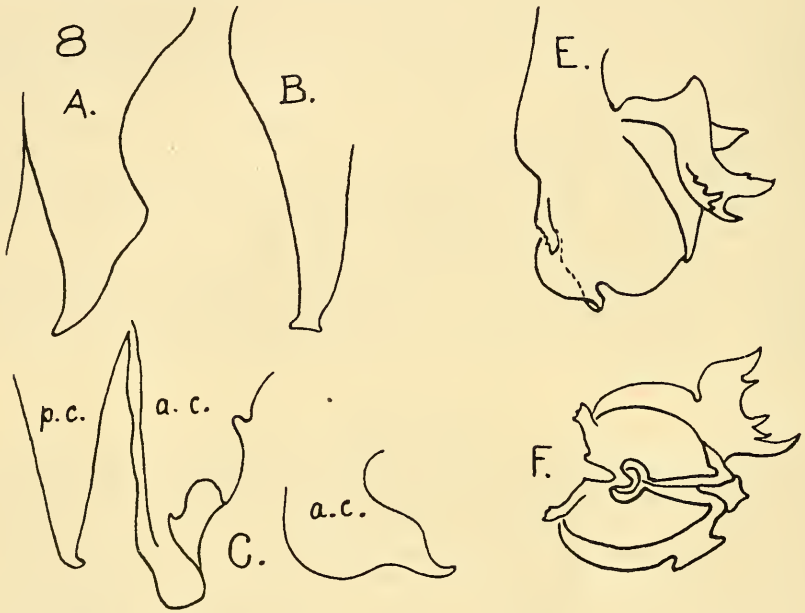
Sarcophaga bancrofti and *S. fergusoni*, two Australian forms, are undoubtedly allied, as also are *S. gamma* and *S. ochidea* judging from Bottcher's drawing of the latter. From a comparison of the illustrations I would have added to the latter pair *S. albiceps* Meigen, as being possibly allied but on receiving a consignment from Mr. Senior-White, from India, I was astonished to find that this form conformed to *S. omega* with regard to type, showing a third relationship and a quite unexpected one. The alliance of *S. synia* with *S. carnaria* has already been suggested and to these may be added, perhaps, *S. crinata* Parker, which in Senior-White's drawing appears to have the same shape of penis although this would not be suspected from Parker's illustration. I think enough has been given to indicate that a systematic search for alliances amongst the Sarcophagas for the purpose of forming groups based on suitable characters and arising from a detailed study of the genital parts must lead to a great advance in the taxonomic treatment of the at present rather unwieldly genus *Sarcophaga*. The following notes deal with the genitalia of exotic Sarcophagas that have been described in Australian literature, and the types of which have at some time or other become available to me. These new notes will make clear some fundamental characters that the original descriptions and drawings leave somewhat obscure.

Sarcophaga millerI Johnston and Tiegs. (Text-fig. 8.)

Rec. Aust. Mus., xiii, p. 185, 1922.

This is the only species yet described from New Zealand. When examining the type in the Australian Museum, I concluded the genitalia were mutilated, but

from further material received from Dr. R. J. Tillyard, it is evident that what was taken to be a mutilation was the normal shape of the genitalia. A drawing from the type is given here where it will be noticed that a large appendage having five or more digits, claw-like in shape though varying in size, is the leading feature of the structure. This occurs only on one side, in a corresponding position on the other side is a short stump giving the appearance of a mutilation. Another character that is not apparent on the original drawing is the outward directed apex of the anterior clasper. Much more material is required before the parts of the penis can be homologized with the corresponding structures in Australian species. The asymmetrical nature is unique unless, perhaps, this is also to be found in the next to be described, *S. multicolor*.

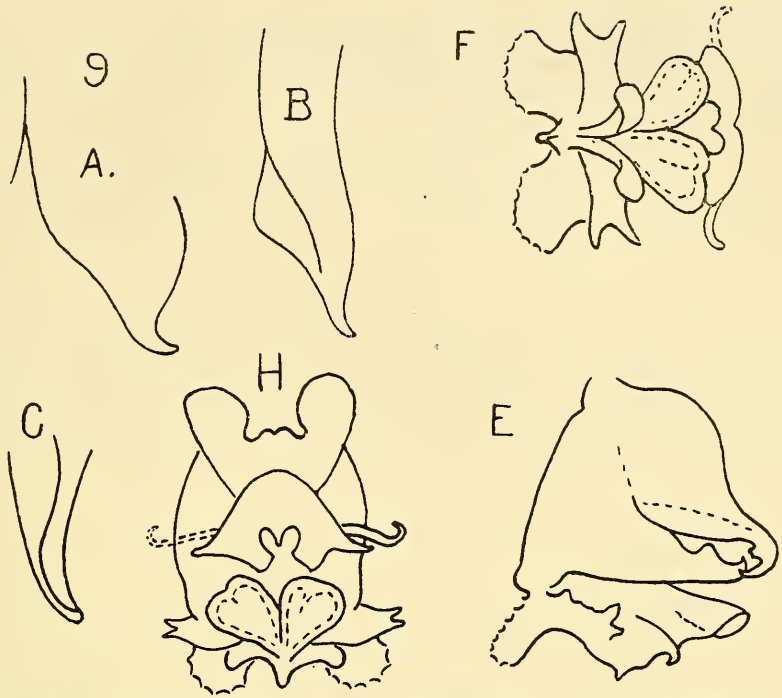


Text-fig. 8. Male genitalia of *Sarcophaga milleri* J. and T. from the type. Lettering as Text-fig. 7.

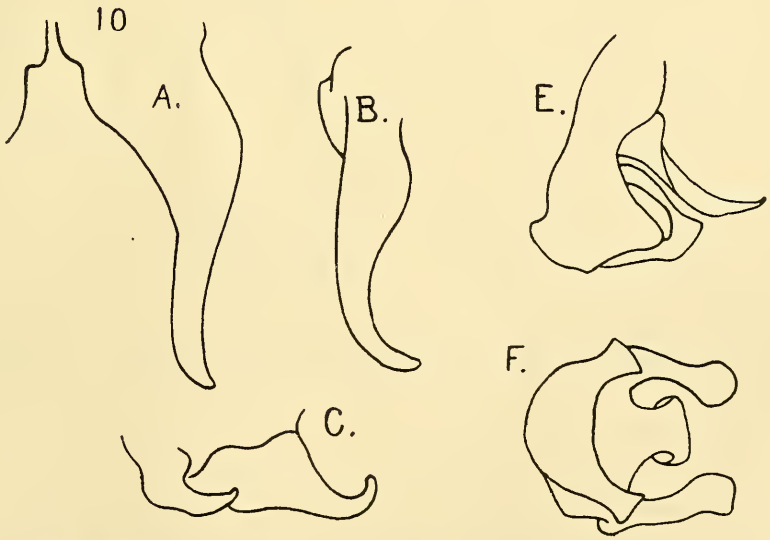
SARCOPHAGA MULTICOLOR Johnston and Tiegs. (Text-fig. 9.)

Rec. Aust. Mus.. xiii, p. 187, 1922.

Although taken from the same specimen, the free-hand drawing made by Tiegs and that given here done by aid of the camera lucida, show fundamental differences in the structure of the forceps and clasper and in the general outline of the penis. It is scarcely likely that these differences are brought about by slight differences in the direction of view and so are best accounted for by differences in the individual conception of the genitalia. The penis is certainly a most complex piece of mechanism and it is extremely difficult to determine its components. A few of the parts remind one of the same parts on *S. milleri*, and were it not for the apparently mutilated process being on the opposite side of the penis, I would have suggested a possible alliance therewith. The two insects are distinct in every other respect.



Text-fig. 9. Male genitalia of *Sarcophaga multicolor* J. and T. from the type. Lettering as Text-fig. 7.



Text-fig. 10. Male genitalia of *Sarcophaga haemorrhoidalis* Fallen, from a specimen described by Johnston and Tiegs. Lettering as Text-fig. 7.

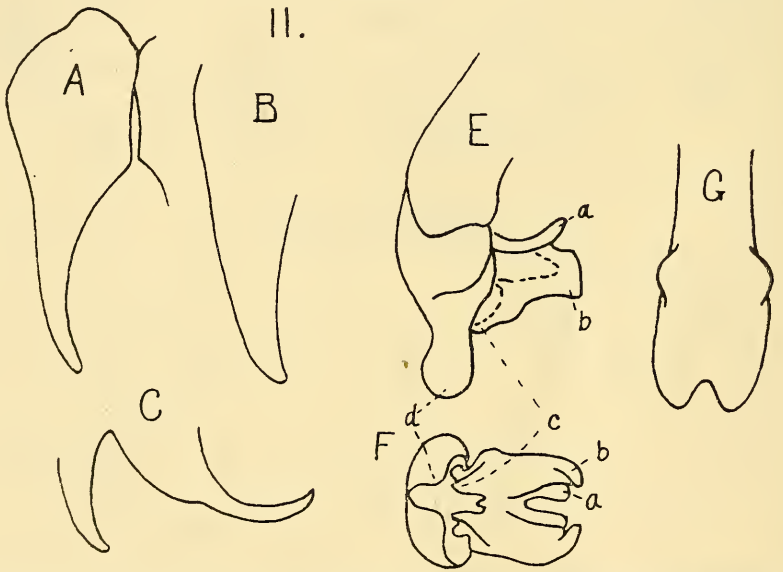
Only one of the claspers was detected on the type, and from its position would appear to be the posterior one. The penis is extremely complicated and a process present on one side appears to have been broken off from the other; its supposed shape is indicated by dotted lines in the figures. The species was described from Rabaul, New Britain, the type being unique.

SARCOPHAGA HAEMORRHOIDALIS Fallen. (Text-fig. 10.)

The Hawaiian specimen described by Johnston and Tiegs has been further studied and more detailed drawings of the genitalia are incorporated here.

SARCOPHAGA PALLINERVIS Thomas. (Text-fig. 11.)

The genitalia on that Hawaiian specimen illustrated by Johnston and Tiegs has been drawn in further detail and as it is not easy to homologize the parts given in the two figures, these are indicated by the letters a, b, c and d. Compare illustration with those of Aldrich "Sarcophaga and Allies", No. 49, *S. peniculata* Parker, and Nos. 120, 121, *S. communis* Parker; presumably these, *S. floridensis* and *S. pectinata*, are related.



Text-fig. 11. Male genitalia of *Sarcophaga pallinervis* Thomas, from a specimen described by Johnston and Tiegs. Lettering as Text-fig. 7.

List of Works Referred to.

JOHNSON AND HARDY, 1923.—PROC. LINN. SOC. N.S.W., xlviii, pp. 94-129. This incorporated a list of eighteen works to which must be added for the purposes of the present paper:
PARKER, 1914.—*Proc. Boston Soc. Nat. Hist.*, xxxv, pp. 1-77.
————, 1917.—*Proc. U.S. National Museum*, liv, pp. 89-97.
————, 1919.—*Bull. Brooklyn Entom. Soc.*, xiv, pp. 41-46.
————, 1923.—*Ann. Mag. Nat. Hist.* (9), xi, pp. 123-129.
SENIOR-WHITE, 1924.—*Rec. Indian Mus.*, xxvi, pp. 193-283.
————, 1927.—*Spolia Zeylanica*, xiv, pp. 77-83.